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Case Report

Severe hepatic impairment after sevoflurane anesthesia in a 10-month-old child: Case report

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ABSTRACT

Introduction: Like other halogenated agents, sevoflurane can potentially cause a toxic reaction including severe hepatic failure which can lead to the death of the patient. However, Halogen immuno-allergic hepatitis is a very rare complication of anesthesia. We reported a 10 months' child who presented a severe hepatic injury after sevoflurane exposure.

Case management: A 10-month-old child was scheduled for acute intussusception anesthesia, induction was done with sevoflurane and propofol while maintenance of anesthesia was provided by sevoflurane alone. Three days after the operation, he was developed jaundice and altered general condition. A dramatic increase in liver enzymes was observed. The evolution was marked by an alteration of his consciousness and his hemodynamic state, he was intubated. Without improvement, the patient died on the 4th postoperative day. The autopsy was refused by the family.

Conclusion: These results underscore the need findings for a global and comprehensive understanding of the potential hepatotoxicity of exposure to volatile anesthetics including sevoflurane in infants and its long-term side effects which can be fatal.

1. Introduction

Sevoflurane is a substance that is foreign to human organism. As other halogenated agents, it can potentially cause a toxic reaction. It is widely used because it is considered as a safe inhaled anesthetic, Especially in patients with liver disease [1].

Theoretically, all organs can be touch by its toxicity especially those who are implicated in its metabolism and elimination, since they the organs where concentrations are at its highest. This is particularly the case of the liver [2]. Indeed, a few cases of hepatotoxicity have been reported in the literature since its use in anesthesia.

No test, including liver biopsy, is specific enough to assert cytolytic hepatitis related to halogens. The diagnosis approach therefore remains based on the anamnesis and other cause of liver injury differential diagnosis elimination, notably infectious, autoimmune, metabolic or hemodynamic etiology.

We report a case of severe hepatic injury in an infant underwent a cure of Intussusception with administration of sevoflurane as maintenance agent.

2. Case management

We report the case of a 10-month-old child from Morocco, resulting from a well-followed pregnancy with a post-term cesarean delivery. The child had a birth weight of 4kg250mg, Good psychomotor development, vaccinated according to the national vaccination program. He had no previous medical, family, psychosocial and genetic history, with no notion of blood transfusions, antibiotics, intravenous drug use, or

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exposure to other chemicals and hepatotoxic drugs.

The preoperative Blood tests were as follow: normal white cells (8600/mm^3), hemoglobin (Hb) was 13.7 g/dl, hematocrit 36.8%, normal C-reactive protein 5,5 mg/l, normal hepatic function, normal kidney function with serum creatinine at 0.6 mg/dl and normal electrolytes.

The patient was admitted to the operating room for treatment of an acute intussusception (intestinal obstruction). Under general anesthesia, gradual induction was performed by sevoflurane with a concentration of up to 7%, and by propofol 3.5 mg/kg after having set up a 24-gauge (G) peripheral venous line. The anesthesia was maintained on sevoflurane. The operative act lasted 45 min without incident. After waking up and extubating on an operating table under conditions of normo-thermia, normo-cardia and normo-tension, he was transferred to pediatric surgery for the post-operative consequences.

On the third day postoperatively, the infant was transferred in the pediatric intensive care for developing jaundice and altered general condition. On admission; he was afebrile (his temperature was 37.2), Lethargic, drowsy; unresponsive the physical examination revealed jaundice and clean surgical mark; he was hemodynamically stable.

His electrolytes values were within the normal range and he showed no clinical or biological signs of sepsis; however, his liver function test was disturbed: γ-glutamyl-transferase: 112 UI/L, Lactate dehydrogenase:2133U/L, glutamic oxaloacetic transaminase: 5323UI/l, alanine-aminotransferase:5884 UI/l, Bilirubin: 70.40 mg/l, The prothrombin time: 29%

Clinical investigations have not revealed any cause of acute hepatic impairment other than the presumed hepatotoxicity of sevoflurane.

In this life-threatening situation, liver transplantation was considered but not feasible in our context.

The patient had no pericardial effusion, no evidence of Budd-Chiari syndrome, no portal vein and hepatic artery thrombosis, and no acute viral hepatitis.

The evolution was marked by the alteration of the neurological state for which it was intubated. The CT Scan of the brain was carried out and was unremarkable. Another blood test has showed up a Prothrombin time of 8%. The case was discussed in a multidisciplinary meeting between resuscitators-anesthesiologists, pediatric surgeons, pediatricians and radiologists and the decision was liver transplantation.

Without improvement, the patient died on the 4th postoperative day. The autopsy was refused by the family.

This case reports follows scare guidelines [3].

3. Discussion

Sevoflurane has been implicated in several cases reports of hepatotoxicity in children [1,2] and single isolated cases of sevofluran-induced liver failure have been reported in elderly patients with comorbid diseases [4,5].

The hepatoxicity of halogenated derivates can be of 2 types [6]: the first, non-immunoallergic, frequent, is revealed by a transient and benign hepatic failure.

Focal hepatocellular lesions, related to a deficiency of glutathione as a scavenger of free radicals and an increase in these, cause cell membranes damage [7].

The second, of immuno-allergic origin, exceptional, causes severe and fatal cytolytic hepatitis in 50% of cases if no hepatic transplant is provided.

The hepatotoxic potential of different volatile an aesthetics is halothane > enflurane > isoflurane > desflurane, and sevoflurane is considered the least hepatotoxic [8].

Sevoflurane undergoes limited biotransformation and causes a minimal reduction in hepatic blood flow [9,10]. It is rapidly metabolized and does not tend to lead to the formation of immunogenic liver protein conjugates [11].

However, sevoflurane-induced hepatotoxicity is likely multifactorial:

- Proposed mechanisms include production of compound A (2-fluorome thoxy1,1,3,3,3-pentafluoro-1-propene), which results from the reaction of sevoflurane with carbon dioxide absorbers. This compound can either interact with proteins and become neoantigens directly or lead to the formation of potentially immunizing fluoroacyl derivatives. Antibodies against trifluoroacetylated (TFA) were found elevated in guinea pigs' serum [12].
- Disruption of calcium homeostasis: Similar to other volatile anesthetic agents, they could deregulate the mechanisms of cellular calcium homeostasis (and more particularly can increase cytosolic free Ca (2+) by releasing calcium from internal stores and induces uptake of calcium from extra and intracellular), leading to hepatocyte necrosis [13].

Many drugs, chemicals, narcotics and herbal therapies can be responsible for this toxicity. Apart from a clear exposure to a high dose of a toxic substance known for its hepatic risks, only a rigorous approach based on an anamnesis and the diagnosis of elimination of other etiologies can lead to the diagnosis of toxic hepatitis with sevoflurane.

4. Conclusion

Sevoflurane is not known theoretically be responsible for this type of hepatitis. Our case report suggests that this halogen may be responsible for a very rare severe hepatotoxicity, with a pathophysiology that remains unclear.

Ethical approval

The ethical committee approval was not required give the article type case report. However, the written consent to publish the clinical data of the patients was given and is available to check by the handling editor if needed.

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Consent

Written informed Consent was obtained from the child's parents for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request. Registration of Research Studies. This is not an original research project involving human participants in an interventional or an observational study but a case report. This registration is was not required.

Guarantor

EL AIDOUNI Ghizlane.

Authors contribution

ELAIDOUNI Ghizlane: Corresponding author, study concept, Data collection, data analysis, writing review & editing.
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LAZREG Moussa: Contributor.
KACHMAR Safae: Contributor.
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BOUCHLAGHEM Amine: Contributor.
CHATAR Mohammed Charaf-eddine: Contributor.
LAMZOURI Oussama: Contributor.

BKIYAR Houssam: supervision and data validation.
HOUSNI Brahim: supervision and data validation.

Registration of Research Studies

This is not an original research project involving human participants in an interventional or an observational study but a case report. This registration was not required.

Provenance and peer review

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Declaration of competing interest

The authors state that they have no conflicts of interest for this report.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2021.102915.

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